WHAT IS CLAIMED IS:

1. An apparatus for programmably manipulating a packet, said apparatus comprising:

a reaction surface configured to provide an interaction site for said packet;

an inlet port coupled to said reaction surface and configured to introduce said packet onto said reaction surface;

means for generating a programmable manipulation force upon said packet to programmably move said packet about said reaction surface along arbitrarily chosen paths; and

a position sensor coupled to said reaction surface and configured to sense a position of said packet on said reaction surface; and

a controller coupled to said means for generating a programmable manipulating force and to said position sensor, said controller configured to adjust said programmable manipulation force according to said position.

2. The apparatus of claim 1, further comprising an outlet port coupled to said reaction surface and configured to collect said packet from said reaction surface.

3. The apparatus of claim 1, wherein said means for generating a manipulation force comprises a conductor adapted to generate an electric field.

4. The apparatus of claim 1, wherein said means for generating a manipulation force comprises a light source.

5. The apparatus of claim 1, wherein said manipulation force comprises a dielectrophoretic force, an electrophoretic force, an optical force, a mechanical force, or any combination thereof.

6. The apparatus of claim 1, wherein said position sensor comprises a conductor configured to measure an electrical impedance of said packet.

7. The apparatus of claim 1, wherein said position sensor comprises an optical system configured to monitor said position of said packet.

8. The apparatus of claim 1, wherein said means for generating a programmable manipulation force and said position sensor are integral.

9. An apparatus for microfluidic processing by programmably manipulating packets, said apparatus comprising:

a reaction surface configured to provide an interaction site for said packets;

an inlet port coupled to said reaction surface and configured to introduce said packets onto said reaction surface;

an array of driving electrodes coupled to said reaction surface and configured to generate a programmable manipulation force upon said packets to direct said microfluidic processing by moving said packets along arbitrarily chosen paths; and

an array of impedance sensing electrodes coupled to said reaction surface and configured to sense a position of said packets during said microfluidic processing.

10. The apparatus of claim 9, further comprising an outlet port coupled to said reaction surface and configured to collect said packets from said reaction surface.

11. The apparatus of claim 9, further comprising a controller coupled to said array of driving electrodes and to said array of impedance sensing electrodes, said controller adapted to provide a feedback from said array of impedance sensing electrodes to said array of driving electrodes.

12. The apparatus of claim 9, wherein said array of driving electrodes and said array of impedance sensing electrodes are integral.

13. The apparatus of claim 9 further comprising an integrated circuit coupled to said array of driving electrodes and to said array of impedance sensing electrodes.

14. The apparatus of claim 9 further comprising a coating modifying a hydrophobicity of said reaction surface.

15. The apparatus of claim 9, further comprising a maintenance port.

16. An apparatus for processing packets in a partitioning medium, said apparatus comprising:

a chamber configured to contain said packets and said partitioning medium;

a programmable dielectrophoretic array coupled to said chamber and configured to generate a programmable dielectrophoretic force to direct processing of said packets; and

an impedance sensing array of electrodes integral with said programmable dielectrophoretic array, said impedance sensing array of electrodes configured to sense a position of said packets within said chamber.

17. The apparatus of claim 16, further comprising an integrated circuit coupled to said programmable dielectrophoretic array and to said impedance sensing array of electrodes.

18. The apparatus of claim 16, further comprising a controller coupled to said programmable dielectrophoretic array and to said impedance sensing array of electrodes, said controller adapted to provide a feedback from said impedance sensing array of electrodes to said programmable dielectrophoretic array.

19. The apparatus of claim 16, wherein said electrodes are between about 1 micron and about 200 microns and are spaced between about 1 micron and about 200 microns.

20. A method for manipulating a packet, comprising:

providing a reaction surface, an inlet port coupled to said reaction surface, means for generating a programmable manipulation force upon said packet, a position sensor coupled to said reaction surface, and a controller coupled to said means for generating a programmable manipulation force and to said position sensor;

introducing a material onto said reaction surface with said inlet port;

compartmentalizing said material to form said packet;

sensing a position of said packet with said position sensor;

applying a programmable manipulation force on said packet at said position with said means for generating a programmable manipulation force, said programmable manipulation force being adjustable according to said position by said controller;

programmably moving said packet according to said programmable manipulation force along arbitrarily chosen paths.

21. The method of claim 20, wherein said packet comprises a fluid packet, an encapsulated packet, or a solid packet.

22. The method of claim 20, wherein said compartmentalizing comprises suspending said material in a partitioning medium.

23. The method of claim 22, wherein said material is immiscible in said partitioning medium.

24. The method of claim 22, wherein said reaction surface includes a coating, and a hydrophobicity of said coating is greater than a hydrophobicity of said partitioning medium.

25. The method of claim 20, wherein said applying a programmable manipulation force comprises applying a driving signal to one or more driving electrodes arranged in an array to generate said programmable manipulation force.

26. The method of claim 20, wherein said programmable manipulation force comprises a dielectrophoretic force, an electrophoretic force, an optical force, a mechanical force, or any combination thereof.

27. The method of claim 20, wherein said sensing a position comprises applying a sensing signal to one or more impedance sensing electrodes arranged in an array to detect an impedance associated with said packet.

28. The method of claim 20, further comprising interacting said packet, wherein said interacting comprises moving, fusing, merging, mixing, reacting, metering, dividing, splitting, sensing, collecting, or any combination thereof.

29. A method of fluidic processing, said method comprising:

providing a reaction surface, an inlet port coupled to said reaction surface , an array of driving electrodes coupled to said reaction surface, and an array of impedance sensing electrodes coupled to said reaction surface;

introducing one or more materials onto said reaction surface with said inlet port;

compartmentalizing said one or more materials to form a plurality of packets;

applying a sensing signal to one or more of said impedance sensing electrodes to determine a position of one or more of said plurality of packets; and

applying a driving signal to one or more of said driving electrodes to generate a programmable manipulation force on one or more of said plurality of packets at said position; and

interacting one or more of said plurality of packets according to said programmable manipulation force.

30. The method of claim 29, wherein at least one of said plurality of packets comprises a fluid packet, an encapsulated packet, or a solid packet.

31. The method of claim 29, wherein said sensing signal and said driving signal comprise a single processing signal.

32. The method of claim 31, wherein said processing signal comprises a first frequency component corresponding to said sensing signal and a second frequency component corresponding to said driving signal.

33. The method of claim 29, further comprising forming a packet distribution map according to said positions of said plurality of packets.

34. The method of claim 29, further comprising determining a position of one or more obstructions on said reaction surface.

35. The method of claim 29, wherein said interacting comprises moving, fusing, merging, mixing, reacting, metering, dividing, splitting, sensing, collecting, or any combination thereof.

36. A method for manipulating one or more packets on a reaction surface, comprising:

providing a programmable dielectrophoretic array coupled to said reaction surface and an impedance sensing array of electrodes integral with said programmable dielectrophoretic array;

introducing a material onto said reaction surface;

compartmentalizing said material to form said one or more packets;

specifying a path upon said reaction surface;

applying a programmable manipulation force with said programmable dielectrophoretic array on said one or more packets to move said one or more packets along said path;

sensing a position of said one or more packets with said impedance sensing array of electrodes;

monitoring whether said position corresponds to said path; and

interacting said one or more packets.

37. The method of claim 36, wherein at lease one of said one or more packets comprises a fluid packet, an encapsulated packet, or a solid packet.

38. The method of claim 36, further comprising:

sensing a position of an obstruction;

determining a modified path, said modified path avoiding said obstruction; and

applying a programmable manipulation force on said one or more packets to move said one or more packets along said modified path.

39. The method of claim 36, wherein said specifying a path comprises specifying an initial position and a final position.

40. The method of claim 36, wherein said introducing a material comprises extracting said material with a dielectrophoretic extraction force from an injector onto said reaction surface.

41. The method of claim 36, wherein said interacting comprises moving, fusing, merging, mixing, reacting, metering, dividing, splitting, sensing, collecting, or any combination thereof.